

## CLAIMS

What is claimed is:

- 5     1.     An ionization gauge, comprising:  
         an electron source for generating electrons;  
         a collector electrode for collecting ions formed by the impact between  
         the electrons and gas molecules; and  
         an electron window which isolates the electron source from the gas  
10     molecules.
2.     The ionization gauge of claim 1, further comprising:  
         an acceleration electrode between the electron source and the electron  
         window to accelerate the electrons to an energy which allows the electrons to be  
15     transmitted through the electron window; and  
         a deceleration electrode between the electron window and the collector  
         electrode to decelerate the electrons.
3.     The ionization gauge of claim 2, wherein the acceleration electrode includes a  
20     plurality of acceleration electrodes.
4.     The ionization gauge of claim 2, wherein the deceleration electrode includes a  
         plurality of deceleration electrodes.
- 25     5.     The ionization gauge of claim 2, further comprising an anode defining an anode  
         volume, the anode surrounding the collector electrode.
6.     The ionization gauge of claim 5, wherein the collector electrode includes a  
         plurality of collector electrodes.

7. The ionization gauge of claim 2, further comprising a mass filter between the deceleration electrode and the collector electrode.
- 5 8. The ionization gauge of claim 2, where the acceleration electrode is maintained at an electric potential so that the potential difference between the electron source and the acceleration electrode is at a range of 100 volts to 10,000 volts.
- 9 10 The ionization gauge of claim 2, where the deceleration electrode is maintained at an electric potential so that the potential difference between the electron window and the deceleration electrode is at a range of 0 volt to 10,000 volts.
- 10 15 The ionization gauge of claim 2, further comprising:  
an outside collector electrode between the electron window and the deceleration electrode.
11. The ionization gauge of claim 10, wherein the outside collector electrode includes a plurality of outside collector electrodes.
- 20 12. The ionization gauge of claim 1, further comprising:  
a shield defining a shielded volume, the shield being at least partially open to permit transfer of the gas molecules into the shielded volume.
13. 25 The ionization gauge of claim 12, where the shielded volume houses the electron source, the collector electrode, and the electron window.
14. The ionization gauge of claim 12, where the shield is maintained at a reference potential.

15. The ionization gauge of claim 14, where the reference potential is ground potential.
16. The ionization gauge of claim 1, where the gauge is a pressure gauge.
- 5 17. The ionization gauge of claim 1, where the gauge is of the Bayard-Alpert type.
18. The ionization gauge of claim 1, where the gauge is a residual gas analyzer.
- 10 19. The ionization gauge of claim 1, further comprising an anode defining an anode volume which retains the electrons in a region of the anode.
20. The ionization gauge of claim 19, where the collector electrode is within the anode volume.
- 15 21. The ionization gauge of claim 20, where the collector electrode includes a plurality of collector electrodes within the anode volume.
- 20 22. The ionization gauge of claim 19, where the collector electrode is outside the anode volume.
23. The ionization gauge of claim 22, where the collector electrode includes a plurality of collector electrodes outside the anode volume.
- 25 24. The ionization gauge of claim 1, further comprising a mass filter for separating the ions based on mass-to-charge ratio.
25. The ionization gauge of claim 1, where the electron source includes a plurality of electron sources for generating electrons.

26. A method of measuring a gas pressure from gas molecules and atoms, comprising the steps of:
- producing electrons at an electron source;
  - transmitting the electrons through an electron window, the electron window isolating the electron source from the gas molecules; and
  - collecting ions formed by impact between the electrons and the gas molecules and atoms on a collector electrode.
27. The method of claim 26, where the step of producing electrons includes using a plurality of electron sources to generate the electrons.
28. The method of claim 26, where the step of transmitting the electrons includes using an acceleration electrode, accelerating the electrons to an energy which allows the electrons to be transmitted through the electron window.
29. The method of claim 28, where using an acceleration electrode includes using a plurality of acceleration electrodes to accelerate the electrons to an energy which allows the electrons to be transmitted through the electron window.
30. The method of claim 28, where the acceleration electrode is maintained at an electric potential so that the potential difference between the electron source and the acceleration electrode is at a range of 100 volts to 10,000 volts.
31. The method of claim 26, where the step of collecting ions includes decelerating the electrons using a deceleration electrode.
32. The method of claim 31, where using a deceleration electrode includes using a plurality of deceleration electrodes to decelerate the electrons.

33. The method of claim 31, where the deceleration electrode is maintained at an electric potential so that the potential difference between the electron window and the deceleration electrode is at a range of 0 volt to 10,000 volts.
- 5 34. The method of claim 31, further comprising the step of:  
collecting ions on an outside collector electrode, the outside collector electrode being between the electron window and the deceleration electrode.
- 10 35. The method of claim 26, further comprising the step of:  
stabilizing the sensitivity using a shield, the shield defining a shielded volume, the shield is at least partially open to permit transfer of the gas molecules and atoms into the shielded volume so potentials external to the shield do not disturb the electric charge distribution within the shielded volume.
- 15 36. The method of claim 35, where the shielded volume houses the electron source, the collector electrode, and the electron window.
37. The method of claim 35, where the shield is maintained at a reference potential.
- 20 38. The method of claim 37, where the reference potential is ground potential.
39. The method of claim 26, where the collected ions are used to measure pressure.
40. The method of claim 26, where the collected ions are used to determine a gas type.
- 25 41. The method of claim 26, where the collector electrode is within an anode volume defined by an anode.

42. The method of claim 41, where the collector electrode includes a plurality of collector electrodes within the anode volume.
43. The method of claim 26, where the collector electrode is outside an anode volume defined by an anode.
44. The method of claim 43, where the collector electrode includes a plurality of collector electrodes outside the anode volume.
45. The method of claim 26, further comprising separating the ions with a mass filter based on mass-to-charge ratio.
46. An ionization gauge, comprising:  
means for producing electrons;  
means for collecting ions formed by impact between electrons from an electron source and gas molecules; and  
means for isolating the means for producing electrons from the gas molecules.